

the results for 20 patients who participated in the autologous transfusion program were compared with those for 20 control patients. An average of five units of autologous blood was collected before operation from the participants. The average length of time from the first visit to the blood bank for phlebotomy to surgical operation was 8½ weeks. No patient came to surgery with an hematocrit of less than 30 percent. Complications associated with collection were minor and were related to transitory hypotension.

Of the 20 participants, 7 required no homologous blood and 13 required additional homologous blood. There were no complications associated with the transfusion of autologous blood. However, there was one patient who participated in the autologous blood transfusion program who did have a weak isoleucoagglutinin transfusion reaction upon receipt of a unit of homologous blood. Transfusion reactions developed in two patients in the control group; in one a weak cold agglutinin developed and in the other a weak isoleucoagglutinin reaction occurred.

The patients who participated in the program were predominantly young females undergoing extensive surgical procedures and requiring massive transfusions. The use of autologous blood reduced the risk of disease transmission, avoided hemolytic transfusion reaction as well as minor transfusion reactions, and reduced the risk of isoantibody sensitization, which might complicate future pregnancies. The use of autologous blood for transfusion reduces perioperative and postoperative morbidity and its wider application for elective orthopaedic procedures is recommended.

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Musculoskeletal Soft Tissue Masses

AN EXTREMITY MASS that is suddenly noted by a patient can be a perplexing and possibly serious problem. A few special studies may be helpful, but most of the important information can be obtained by a simple history, physical examination, x-ray films and basic laboratory studies. It is reassuring that most of all such suddenly appearing lumps are benign but since the individual odds

are either zero or 100 percent (it is either a cancer or not) it is good practice to consider all of them malignant until proven otherwise.

Distinguishing a solid (probably neoplastic) mass from a fluid mass is most easily done by transillumination. Optimally, there must be time for dark adaptation and a shielded light source in a completely darkened room. If the mass does not brightly transilluminate, it is probably a solid tumor and a biopsy specimen must be taken without delay. The only solid tumors that transilluminate are lipomas and, occasionally, low-grade liposarcoma. Hematomas, although fluid, will not transilluminate. If the mass transilluminates, it should be aspirated for confirmation and specific studies, occasionally including the injection of water-soluble contrast material for a "cavigram." If the mass is attached to the skin, particularly by a scar, it suggests an epidermal inclusion cyst. If the mass moves transversely but not in the long axis of the extremity, it suggests a tumor of a peripheral nerve. The consistency of a given mass is not of diagnostic importance and the old aphorism that "cancer is hard" is not reliable. Rapidly growing tumors tend to be soft because of hemorrhage or necrosis. Hemangiomas feel warm to the touch and may diminish in size on elevation of the extremity. Ganglia and cysts communicating with a joint may change in size with motion. If the tumor is in a muscled region, subfascial tumors are *less* palpable and subcutaneous tumors are *more* palpable when the muscle is tensed. Muscle hernias are more prominent on contraction and a fascial defect may be palpable on relaxation.

Biplanar x-ray studies can be supplemented with tangential soft tissue technique films using lead skin markers to delineate very simply the density and extent of the tumor. Specific densities may suggest the diagnosis; heavy flocculant calcification occurs in cartilage matrix and multiple spherical densities are often seen in hemangiomas. A lacy or trabecular pattern can be seen in heterotopic bone formation (myositis ossificans), and dusty calcification may be seen in synovial sarcoma. Low grade liposarcomas occasionally present with a rim of calcification at a portion of their periphery. Angiography helps delineate the extent of the mass, may differentiate infection from a vascular malignant tumor, and shows major vessels to the surgeon or radiologist for surgical planning, consideration of chemotherapy infusion, or embolization. Computerized axial

tomography is almost mandatory in the preoperative evaluation of extremity tumors and is most helpful in the design of muscle group resection or decision to amputate. Computerized tomographic lung examination is also the best way to search for metastatic pulmonary nodules.

Consultation with a surgical pathologist and a surgeon experienced in extremity surgical procedures is advisable before taking a biopsy specimen of a probable primary malignancy. An unconsidered biopsy study, particularly in a difficult location, may lead to excess blood loss and excessive regional dissemination of tumor cells, and may complicate the definitive en bloc resection of the biopsy tract or surgical scar with the major tumor.

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Management of Musculokeletal Sarcomas

SARCOMAS ARISING in the locomotor tissues are dangerous for several reasons. First, they are rare (less than one percent of all malignant lesions) so a high index of suspicion is necessary or else cancer will be forgotten in the differential diagnosis. Second, metastases tend to occur early and are difficult to discover. Third, these tumors have a pseudocapsule and are easily "shelled out," leaving a surface of raw tissue with residual tumor cells to find their way into the blood and lymph vessels. Fourth, manipulation and bleeding at the time of biopsy cause dissection along tissue planes which spread living tumor cells relatively far from the surgical site. Finally, they may become locally advanced before they cause enough symptoms to be noticed. When the tumor is discovered, an *immediate investigation* is in order since the tumor will have been present for a long time.

The first step is to establish the diagnosis with certainty. There are perhaps two dozen types of sarcomas of soft tissues each of which has its proclivities as to sex, body location, local aggressiveness, tendency to metastasize, response to treatment modalities and ultimate prognosis. Because mesenchymal tissues are derived from com-

mon stem cells, sarcomas may be quite primitive locally even when otherwise differentiated. There may even be different tissues in the tumor. The surgical pathologist then is often faced with a bewildering histopathological problem in diagnosis. Obviously, the rarity of these tumors affords maximum experience to only a few surgical pathologists. A frozen section examination is not realistic at the time of biopsy because consultation, special stains and occasionally electron microscopy may be necessary before diagnosis.

The second step determines the stage of the tumor: local, regional or distant. Angiography and computerized axial tomography are helpful in showing the extent of the tumor and its relationship to bone, nerve and blood vessels. Ultrasound imaging is less helpful. Lymphography is being studied but is as yet not proven to be useful in planning surgical therapy or radiotherapy. If routine x-ray films of the chest are negative, pulmonary computerized axial tomography will identify metastases less than a centimeter in diameter. Radionuclide bone scan is helpful in finding asymptomatic skeletal metastases. Liver and brain scans are optional, but have not proven helpful unless there is a specific indication.

Cancer persists in at least two thirds of local excisions and up to a third of patients who are managed by radical excision, depending on several variables. Radical local excision must include one full uninvaded tissue-plane from the tumor in all three dimensions. This may necessitate resection of bone or major muscles, amputation or skin grafting. Additionally, vascular or nerve resection and reconstruction will occasionally be mandated by clinical, angiographic, electromyographic or operative findings. External megavoltage radiotherapy may be advisable to sterilize any residual locally micropersistent tumor cells. Interstitial after-loading techniques using iodine 125 or iridium 192 may be helpful for macro-locally-persistent tumor, or to sterilize the tumor bed. Using this, the irradiation dose can be pushed to 10,000 rads in a small volume of tissue using this still-evolving technique. Adjuvant doxorubicin cycled with high dose methotrexate and citrovorum rescue, or with moderate dose methotrexate, have been shown to improve survival and disease free intervals in many of the soft tissue sarcomas. Other agents and combinations are also being used as adjuvant chemotherapy. Wound healing must be uncomplicated before initiating external irradiation or these medications and if